

ASSESSMENT OF RADIOACTIVE CONTAMINATION AND
RISKS FROM EXPOSURE AT THE JANA ELEMENTARY SCHOOL
AND NEARBY RESIDENCIAL AREA
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17 Oct 2022

Qualifications

This report was prepared by Richard Troast, Ph.D. of Troast Environmental Consulting, LLC. Dr. Troast is a toxicologist and environmental scientist with over 35 years of experience assessing the toxic exposures and risks of chemicals in the environment both in the US and internationally.

Dr. Troast has written guidance for reducing the threat of lead exposure while at the US Environmental Protection Agency where he served for 33 years prior to his retirement. At the US EPA, he held positions of scientist, risk assessor and finally senior scientist for the US EPA "Superfund" program where he was responsible for setting remediation standards for hazardous waste sites of both metals (i.e., lead) and other chemicals.

After retiring from the USEPA Dr. Troast was selected to represent the US Agency for International Development (AID) in the Kingdom of Jordan where he served as the Advisor to Minister of Environment. In this capacity, Dr. Troast developed improved practices for use within the Kingdom to measure hazardous materials within the confines of the towns and cities; designed testing procedures for identifying lead-based paint; and improving laboratory procedures within the Kingdom's testing laboratories.

Concurrent with his time at the USEPA, Dr. Troast served in the US Army and the Army Reserves for 25 years as a chemical officer before retiring as a Lt. Colonel. In this capacity he and the units he commanded provided hazard assessments in the case of release of chemical or radiological materials.

Dr. Troast was an adjunct professor in Biology and Toxicology for several years prior to and shortly after retiring from the USEPA. He taught at two Community Colleges within the State of Virginia, Lord Fairfax and Germanna.

INTRODUCTION

The identification of dangerous and potentially cancer- causing radioactive chemicals on the grounds of Jana School were identified in the report of Dr. Marco Kaltfen. In his report, he stated that radium and thorium radionuclides that degrade by emitting alpha particles were found that exceeded background levels of 5pCi/g.

The released dose such as 5pCi/g released as a presumptive safe background level quantifies the amount of energy transferred to a

volume of material, but it does not reflect the potential biological damage that could occur.

TOXICOLOGICAL HAZARDS

The International Agency for Research on Cancer is a respected organization founded to identify cancerous compounds and provide guidance to a global audience. Their reports are widely used to evaluate reports on multiple chemicals using data large numbers of laboratories and government research groups.

The IARC published a report on the hazards of radioactive chemicals with alpha-emitting particles for the following radionuclides identified in the Jana School area. The following is

Thorium- 230

Actual human test data is available for Thorium-230. Thorium-230 was once used for radiographic purposes in cancer treatments between 1930 and 1960's. The uses for radiography were stopped after multiple cases of cancer in livers, larynx, bronchi, and kidneys were discovered after treatment.

An important consideration of the toxicity of Thorium is its very long retention time once ingested, inhaled and absorbed via the small intestine into the body. The body burden of Thorium-230 has been reported to extend for decades depending on the age of the person who was exposed to Thorium. IARC in their report on carcinogenicity of radioactive chemicals, has suggested that lifelong cumulative exposure will result in cumulative toxicity within the residents who are exposed to Thorium-230.

The concentration of Thorium-230 decreases in the body in the following order in humans not occupationally exposed: lymph nodes >

lung > bone > kidney > liver. Thorium-232 deposition locations within the human body is approximately 11-25% in the lung and 55-70% in the skeleton.

RADIUM-226 and RADIUM-228

The IARC report on alpha particle emitters has stated that there is sufficient evidence to classify radium-226 as a human carcinogen that results in bone sarcomas and carcinomas. A carcinoma forms in the skin or tissue cells that line the body's internal organs, such as the kidneys and liver. A sarcoma grows in the body's connective tissue cells, which include fat, blood vessels, nerves, bones, muscles, deep skin tissues and cartilage. A carcinoma is more likely to invade adjacent tissue, spreading through the lymph nodes. IARC classified both radium-226 and radium-228 as human carcinogens.

The ATSDR reported in its Toxicological Profile for Radium radium-226 is chemically similar to calcium, and therefore radium-226 deposits in bone within those areas where new bone mineral is being formed and on all bone surfaces just as calcium normally does. As a result of this deposition process, radium-226 remains in the skeleton indefinitely.

LEAD-210 and POLONIUM-210

The IARC Report on Inorganic Lead classified inorganic lead compounds as probably carcinogenic to humans. IARC's data discussed the toxic mechanism of action for the radioactive lead molecule. Stated another way, ingestion of a particle of radioactive lead dust will be metabolized and could be stored within the body where it will damage other body tissues through the emission of alpha particles which are hazardous to the internal structures of the human body.

Polonium-210 is a degradation product found in exposure routes leading to human exposures. A published report in the Journal of Oncology by DR. Zaga stated “Polonium-210 represents one of the principal causes of lung cancer.” This statement means that any exposure route that allows the alpha-particle emitting particle to reach a deposition point such as lung tissue can suffer damages over the period of time that the particle(s) continue to decay and emit daughter particles

EXPOSURE PATTERN OF THE RADIONUCLIDES NEAR JANA SCHOOL – TRANSFER OF WASTES

The report of the radioactive contamination found at the Jana school prepared by Dr. Kaltofen describes a pattern of radioactive wastes that as he describes “is consistent with the radioactive legacy uranium waste processing found in low-lying areas subject to flooding from the creek {Coldwater Creek}”.

His report continues by describing the radioactive wastes match the wastes that were identified at the St Louis Airport, HISS and other nearby radioactively contaminated sites that are upstream along Coldwater Creek which were established by the US Army Corps of Engineers (USACE).

The USACE was the Federal Agency charged with the management of the hazardous waste storage under a program named FUSRAP (Formerly Utilized Sites Remedial Action Program). FUSRAP was intended to address radiological contamination generated by activities of the Manhattan Engineer District and the Atomic Energy Commission (MED/AEC) during development of the atomic weapons in the 1940s and 1950s.

Testing by the USACE and reported by Dr. Kaltofen demonstrated total radioactivity in well in excess of the 5pCi/gm for surface soil and

15pCi/g for subsurface soil safety thresholds for human health that were established by the USEPA. Dr. Kaltofen's study showed radioactive waste levels in surface soils around the Jana school reach 22.60 ± 4.39 pCi/g. Subsurface soils were identified at 34.30 ± 6.1 pCi/g.

Dr. Kaltofen reported that Thorium-230 was identified in 84 locations above the expected background levels 1.51pCi/g. He reported that the average radioactivity was 6.18 ± 1.46 pCi/g thorium-230.

Dr. Kaltofen noted that significantly no testing was done on the interiors of the Jana school. This is particularly significant in the conduct of a risk estimate such as used in transitioning contaminated soils from an outdoor to indoor exposure scenario.

It has been well-recognized and reported in the published literature that soil contamination is readily transferred into residential and public buildings, (see ATSDR Toxicological Profiles for Lead and USEPA Integrated Science Assessment for Lead). In all situations soil particles and other hazardous waste particles that are clinging to shoes and clothing will be carried indoors where the contamination will be deposited onto indoor surfaces. Indoors depending on cleanliness will allow dust particles to be ingested or inhaled. Multiple USEPA Superfund remedial actions were based on transference of the hazardous material from sources into residences via wind and water. (See Libby, Mt Superfund and Bunker Hill. Idaho Superfund Records of Decision)

Children playing on the bare soil of the Jana school may be inhaling dirt/dust that is contaminated with the radioactive waste. The lack of testing of the soils by the USACE precludes further assessment of the actual risk threshold for non-radioactive injury from lead isotopes identified.

RESIDENTIAL AREA CONTAMINATION

The risks identified as near the Jana school apply to the local residences bounded by Cold Water Creek which serves as a transfer mechanism of the radioactive wastes released from the upstream storage facilities established by the USACE. As noted in Dr. Kaltofen's report indoor samples from creek-facing homes in the Jana school area had the same types of radioactive chemicals as identified on the Jana school location.

ATSDR stated that localized seasonal flooding was to blame for this route of exposure to the nearby population residing in this area, and significantly adding to the exposure that children residing in this area receive from their exposure at the Jana school.

There is little testing data for these properties. Dr. Kaltofen's report stated the sampling conducted by the USACE was not sufficiently close the local homes and the Jana School to be of value.

The properties along Cold Water Creek (The Latty Avenue Properties) were originally contaminated from the re-processing of wastes from the nuclear weapons program. A report filed by the Atomic Energy reported the following "The Mallinckrodt Chemical Company conducted uranium milling and refining operations under contracts with the Manhattan Engineer District and the Atomic Energy Commission at the St. Louis Downtown Site in Missouri. Mallinckrodt transported process residues to the St. Louis Airport Site (also in Missouri) for storage until the Commercial Discount Corporation of Chicago purchased them in 1967; Commercial Discount transported the residues to the Latty Avenue Properties for storage and processing. This material was sold to the Cotter Corporation in 1969 and was dried and shipped to their facilities in Canon City, Colorado. By 1974, most of the material had been sold

and removed from the Latty Avenue Properties, leaving only a reported *residual contamination*.

This is the toxicologically succinct issue. What was then referred to as residual contamination is now known to be a permanent hazard residing along the properties. The USACE *Cold Water Creek Sampling Fact Sheet* (June 30, 2020) describes the elimination of the sources of the releases of the radioactive wastes and excavation of contaminated soils. It does not offer a threshold for action to remediate long-term hazards presumably relying on minimal risks from radioactive sources within the soils.

There are no known absolutely safe levels of contamination by radioactive particles, only a threshold of safety based upon exposure and types of radioactivity released.

In the period after the wastes had been originally processed and transferred in the mid-1970s, there was additional remediation done by the USACE to minimize releases. In the mid-1980's the US Department of Energy was directed to conduct a decontamination research project along Latty Ave. The National Institute for Occupational Safety and Health issued a report in 2011 on residual radioactive contamination as part of the assessment to compensate individuals for exposures received from work in the atomic weapons industry. Included in this survey was property along Latty Ave. The actual report was not found but in a qualifying statement NIOSH wrote that the lack of finding an immediate hazard does *not* mean that there is *no threat exists*.

HEALTH CONCERNS

The reports discussing the hazards of radioactivity too often focus on the short-term effects of the ionizing radiation and overlook the long-term effects of certain radionuclides that can co-locate within a person.

The ATSDR reported in its Toxicological Profile for Radium that radium-226 is chemically similar to calcium, and as such radium-226 deposits in bone within those areas where new bone mineral is being formed and on all bone surfaces just as calcium normally does.

However, radium-226 deposits on bone surfaces and becomes part of the bone. ATSDR's opinion was that radium-226 with its long half-life remains in the skeleton indefinitely.

The ATSDR's Toxicological Profile for Thorium-230 summarized their findings by stating children *may* be more susceptible to both the chemical and radiological effects of thorium than adults. Studies indicated that thorium was absorbed more readily as neonates and adolescents than when they are older. Additional studies including epidemiology studies are needed to further evaluate the potential for age-related differences in thorium toxicity.

Radium and Thorium have been identified in the soils. It is clear that these two compounds provide a large part of the contamination within the Cold-Water Creek area and Jana School.

SUMMARY

The data are clear that even when the exposures are minimized there is still a hazard to the population around the Cold-Water Creek area who are living within the areas of the radiation.

The currently accepted baseline of 5pCi is **not** a safety level per se. It is a bio-marker that demonstrates where the line of departure from known hazards begins. For example, ATSDR noted that above the 5pCi level chromosomal damage can begin to occur. ATSDR recommends as part of a testing protocol for radiation impacts that studies include complete dosimetry matched with epidemiologic review of past diseases that focus on tissues such as the thyroid that undergo active metabolism.

Radioactive hazards present themselves differently to the human populations as some of the chemicals described can assimilate into the human body and continue to cause damage for long periods of time.

The USEPA has addressed radiation hazards in the following statement “Children and fetuses are *especially sensitive to radiation exposure*. The cells in children and fetuses divide rapidly, providing more opportunity for radiation to disrupt the process and cause cell damage. EPA considers differences in sensitivity due to age and sex when revising radiation protection standards.

It is is very clear that the level of radiation found at the Jana elementary school far exceeds the threshold of 5pCi, and the levels of radioactivity identified are likely to result in an unacceptable risk to the children residing in the Cold Water Creek area.

REFERENCES

Zaga, V.; Polonium and Lung Cancer, 2011 Journal of Oncology.

ATSDR Toxicological Profiles for Thorium 2019

ATSDR Toxicological Profile for Radium 1990

International Agency for the Research on Cancer V100D Radiation and Cancer 2012.